An Integrated Study of Vortex Formation of Freely Flying Insects

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Abstract

This is a short introduction illustrating movies submitted to "Fluid Dynamics Videos".

1 Introduction

An integrated approach is introduced to study the free flight of insects (e.g. dragonflies)(Dong et al. 2010). First, High-Speed Photogrammetry is used to record various flight motions. As an example, a dragonfly in a backward taking-off is shown in the video. Three-dimensional surface reconstruction techniques are then applied to obtain the data of body trajectory, wing kinematics and deformation. Based on these data, direct numerical simulation (DNS) of full body is conducted with our in-house high fidelity CFD solver, which is based on sharp interface immerse boundary method (Mittal et al., 2008). The vortex structure created in the process of dragonfly taking-off can be clearly seen. As a further step, tracers and Lagrangian coherent structure (Shadden et al. 2005) are used to understand the vortex formation and facilitate the vortex identification.

Reference

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